THE ROLE OF PERTURBATIONS IN THE B-X UV SPECTRUM OF S_2 IN A TEMPERATURE-DEPENDENT MECHANISM FOR SULFUR MASS INDEPENDENT FRACTIONATION

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Sulfur mass independent fractionation (S-MIF) describes anomalous sulfur isotope ratios commonly found in sedimentary rocks older than 2.45 billion years. These anomalies likely originate from photochemistry of small, sulfur-containing molecules in the atmosphere, and their sudden disappearance from rock samples younger than 2.45 years is thought to be correlated with a sharp rise in atmospheric oxygen levels. The emergence of atmospheric oxygen is an important milestone in the development of life on Earth, but the mechanism for sulfur MIF in an anoxic atmosphere is not well understood. In this context, we present an analysis of the B-X UV spectrum of S_2, an extension of work presented last year. The B state of S_2 is strongly perturbed by the nearby B" state, as originally described by Green and Western (1996). Our analysis suggests that a doorway-mediated transfer mechanism shifts excited state population from the short-lifetime B state to the longer-lifetime B" state. Furthermore, access to the perturbed doorway states is strongly dependent on the population distribution in the ground state. This suggests that the temperature of the Achaean atmosphere may have played a significant role in determining the extent of S-MIF.